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COMPENSATION ARRANGEMENTS BETWEEN HOSPITALS AND PHYSICIANS*

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This paper investigates the pattern of compensation arrangements between hospitals and physicians. Hospitals are assumed to choose a combination of salary and incentive or output-based compensation to maximize utility from profits and physicians' nonpatient care activities. Our theory suggests that medical care prices have implicaions for the choice of compensation method when risk and the costs of supervision are held constant.

We use data from two hospital surveys to estimate an equation explaining the percentage of a hospital's physicians on salary. Salary arrangements are less frequent where the price of physicians' patient care services is high and revenues from grants and the Medicaid program are low. Implications of these results for public policy are discussed.

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I. INTRODUCTION

The hospital is a unique organization in that a principal input in the production of its services, the physician, is generally not a hospital employee. In fact, hospitalized patients frequently receive separate bills for hospitals' and physicians' services and have separate insurance coverage for each type of care. Independent practice and separate fee-for-service billing by physicians explain why most researchers have regarded the hospital and the physician as separate entities.[1]

Most models of the hospital focus on its (typically) not-for-profit status.[2] Although the physician's role is recognized, its implications have not been explicitly explored. Models of physician behavior, on the other hand, have assessed the impacts on physicians of changes in reimbursement by third party payers and changes in the methods by which revenues and costs are shared in group practices.[3] Physicians' output is always measured by patient care services. Although this assumption is appropriate for most purposes, it ignores the time physicians devote to teaching, research, and administration.

Despite the separation of hospitals and physicians in theory, few observers doubt that physicians exercize a crucial role in hospitals' use of resources. Physicians' activities (admitting patients, ordering diagnostic tests, and performing surgical and medical therapies) trigger enormous expenditures, more than $65 billion in 1977, for hospital care.[4]

Furthermore, independent practice is not the only contractual relation between hospitals and physicians. So-called hospital-based physicians (HBPs)--anesthesiologists, radiologists, and pathologists--typically do not have direct contact with patients. Rather, they practice almost exclusively in hospitals, and in a very real sense, their customers are other doctors.

As seen below, the HBPs' hospital orientation is reflected in patterns of HBP compensation.

Finally, although fee-for-service billing by physicians is the most common compensation arrangement, many other arrangements are possible.[5] For our purposes, the various options can be reduced to two prototype cases: salary and incentive compensation. The distinguishing difference is that salary is unrelated to patient care output whereas all forms of incentive compensation are tied to output.

This study investigates the conditions which determine the observed compensation arrangements between physicians and hospitals. Two public policy issues coincide with our analytic interest in physicians' compensation arrangements. Both concern Medicare and Medicaid reimbursement of physicians. The first focuses on the conditions under which teaching physicians may submit fee-for-service bills for care provided to teaching patients. It has been alleged that some teaching physicians may engage in double billing (submitting fees for reimbursement of professional services while at the same time receiving salaries which are reimbursed as a hospital cost).[6] The still-unimplemented Section 227 regulations of the 1972 Social Security Amendments are designed to reduce the possibility of double billing by requiring a very strict test of an existing private patient-physician relationship.

The second issue involves supposedly undesirable consequences of percentage-of-departmental-revenue arrangements, which occur most frequently in the compensation of HBPs.[7] It has been argued that percentage arrangements are responsible for much of the rapid growth in the use of ancillary services in hospitals and in HBPs' earnings.[8] Proposals for Medicare-Medicaid reimbursement reform submitted by Senator Talmadge (95th Congress, S. 1470) would effectively eliminate percentage compensation arrangements. Although we do not investigate these allegations directly, we do ask whether Medicare and Medicaid have had any direct impact on the presence of incentive compensation in teaching hospitals and for HBPs.

The next section of this paper develops a theory of the choice between salary and incentive compensation. Unlike earlier theoretical analyses of contractual arrangements, which have focused on the implications of risk, imperfect information, and the cost of supervision,[9] our theory highlights the effects of variations in prices of hospitals' and physicians' outputs. As such, the theory suggests that government policies which change medical care prices will have implications for the choice of compensation arrangements.

The paper's third section describes empirical tests of our model. We use data from two hospital surveys to estimate an equation explaining the percentage of a hospital's physicians on salary. One survey, conducted by the American Hospital Association (AHA) in 1973, contains data for a sample of all short-term, nonfederal general hospitals.[10] The second survey, conducted by the Institute of Medicine (IOM) in 1975, is limited to teaching hospitals.[11] However, these data provide information on the extent of hospitals' teaching activities and revenues from different sources.

The paper's final section summarizes the results of the empirical analysis and draws implications for public policy. In general, the empirical results are quite consistent with theoretical expectations. Salary arrangements are less frequent where the price of physicians' patient care services is high. However, grants, which are usually associated with nonpatient care activities or charity care, have the opposite effect. Finally, the Medicaid program, through its relatively less generous reimbursement for physicians' services than for inpatient hospital expenses, encourages the frequency of salary arrangements.

II. THEORY

This section begins with a general model of compensation arrangements between physicians and hospitals. Once the comparative statics results have been assessed, we discuss some pertinent institutional features and implications for empirical analysis.

There is one input, physician time, in our model. To keep matters simple, we consider a single representative physician. Results can readily be generalized to more than one doctor. The physician's total work hours are fixed at T. Each hour of work at patient care yields a unit of output. (The same argument applies to effort even though we refer to hours here.)

We assume that the hospital has the following objective function:

(1) $U = U(X,\Pi)$

where X = nonpatient time of physicians

Π = net income.

Physicians' nonpatient care time is devoted to teaching, research, and administration. Hospitals value these activities for reasons of status and prestige, or because the presence of a teaching program increases the perceived quality of the hospital.[12] They seek a profit to subsidize the parent medical school, to support unfunded research and other professional activities of the medical staff, or to build up a reserve for contingencies.

Revenue (R) is obtained from gifts and grants (G), from selling physicians' patient care services, and from hospitalization insurance coverage of physicians' salaries (S). The last two sources of revenue reflect the unique structure of reimbursement for care provided in hospitals: physicians' services, billed on a fee-for-service basis, are covered by medical-surgical insurance, while physicians' salaries are generally considered reimbursable costs to be covered by hospitalization insurance.[13]

We assume that the hospital is a price-taker in the market for medical care (an innocuous assumption that greatly simplifies the analysis). Exogenous supply and demand factors, including insurance for physicians' patient care services in the area in which the hospital is located, determine the going price (p). The share of the hospital's expenses which it expects to collect is represented by the parameter k ($0 < k \leq 1$). This incorporates the effects of the extent and depth of hospital insurance coverage as well as the hospital's collection rate from uninsured patients.[14] The hospital's revenue equation, then, can be written

(2) $R = p(T-X) + kS + G.$

Hospital costs, in our one-input, one-output model, consist of physicians' compensation (C) which, in turn, takes two forms: salary and incentive compensation. For clarity in the following discussion, we define salary as a lump-sum payment independent of physicians' allocation of time. Incentive compensation is paid at the rate of f dollars per unit of patient care. Since profits equal revenues minus costs, we can write the hospital's profit function as

(3) $\Pi = (p-f)(T-X) + G - (1-k)S.$

We assume that physicians (like the hospital) value nonpatient care activities. It is reasonable, then, to postulate that physicians would be willing to accept less compensation in return for the nonmonetary benefits of more nonpatient care time; turning this relation around, we postulate that compensation is an increasing function of patient care time:

(4) $C = C(T - X; Z)$

where Z is any exogenous factor shifting the compensation schedule.

The compensation schedule plays a role in this theory analogous to the wage rate in ordinary labor-demand theory, but, unlike the scalar wage rate, it offers the hospital a "menu" of compensation rates corresponding to different allocations of a physician's time.

The hospital is faced with the following decision. It likes X, but it also like Π. How should it structure the physician's compensation to maximize its welfare? The intuitive answer is to offer a mixture of salary and incentive compensation which induces physicians voluntarily to produce the optimal (utility-maximizing) level of output.

The answer is illustrated by Figure 1, where the upward-bending line represents the physician's compensation schedule (equation(4)). Let the hospital's desired output of patient care be $(T-X)^*$. Then, provided that the compensation schedule is strictly convex, the physician will voluntarily locate at point $(T-X)^*$ if and only if the hospital pays S^* salary and a wage rate equal to the slope of $C(\cdot)$ at $T-X^*$. Higher desired outputs of patient care (points to the right of $(T-X)^*$) require a salary-incentive mix weighted more heavily toward incentives, and vice versa.

In addition to depicting the equilibrium of our model, Figure 1 also shows that the model is related to the hedonic demand theory of Lancaster.[15] Our compensation schedule is an hedonic wage equation for the undesirable on-the-job attribute of more patient care time. If all physicians were identical, then $C(\cdot)$ would simply be the equation of a representative physician's indifference curve; otherwise, $C(\cdot)$ is an equilibrium locus of the sort described by Rosen.[16]

We may formally analyze the hospital's decision by writing the functions for salary and the incentive rate:

$$(5)\quad S = S(T-X;\ Z)$$

$$(6)\quad f = f(T-X;\ Z)$$

where $S_X > 0$ and $f_X < 0$. Substituting (3), (5), and (6) into (1) and differentiating with respect to the choice variable (X), one obtains the first order condition:

Insert Figure 1 about here

$$(7)\quad \partial U/\partial X = U_X + U_\Pi \Pi_X = 0$$

$$\Pi_X = -p + f + kS_X < 0.$$[17]

An interpretation of this condition is that the loss to the hospital in revenue from moving toward more nonpatient care activity exceeds the gain from reduced compensation, i.e., the hospital produces less than the profit-maximizing amount of patient care.

The second order condition is

$$(8)\quad \partial^2 U/\partial X^2 = U_{XX} + 2U_{X\Pi}\,\Pi_X + U_{\Pi\Pi}\,\Pi_X^{\;2} + U_\Pi\,\Pi_{XX} < 0,$$

which must be negative to insure a maximum. A functional form of the compensation function which satisfies equation (8) (and which also helps to sign comparative statics derivatives) is

$$(9)\quad C = a_0\,(T - X) + a_1\,(T - X)^z + a_2 Z$$

where the a's are positive constants. In this case, $\Pi_{XX} = -2a_1(1 + k) < 0$.

We examine four comparative statics problems: an increase in gifts-grants, an increase in output price, an increase in k, the hospital's cost recovery rate, and a change in the "Z" variables (assumed to shift the physician's compensation schedule upward).

An increase in gifts-grants produces the straightforward result that desired patient care time falls and, consequently, the hospital reduces incentive payments and raises salary payments:

$$(10)\quad dX/dG = -(U_{X\Pi} + U_{\Pi\Pi}\,\Pi_X)/\Delta > 0,$$

$$\Delta = \partial^2 U/\partial X^2.$$

Under these circumstances, the model predicts that, for example, cutbacks of National Institute of Health (NIH) research funding or policy changes which reduce indirect payments would stimulate hospitals' efforts to provide more patient care and cause them to structure teaching staff incentives accordingly.

The comparative statics derivative for the response of nonpatient care time to a change in price is:

$$(11)\ dX/dp = -(U_{X\Pi}\, \Pi_p + U_{\Pi\Pi}\, X_\Pi\, \Pi_p + U_\Pi\, \Pi_{Xp})/\Delta \lesseqgtr 0.$$

Here, $\Pi_p = (T - X)$ and $\Pi_{Xp} = -1$. The first two terms are an income effect toward more nonpatient care time and the third is a substitution effect toward patient care. The net result is ambiguous; hence, an increase in the generosity of insurance coverage for physicians' services could conceivably lead to less reliance on incentive payments. If the substitution effect is larger, the "common sense" prediction applies: higher patient care reimbursement leads to greater reliance on incentives.

An increase in the cost recovery rate causes X to increase:

$$(12)\ dX/dk = -(U_{X\Pi}\, \Pi_k + U_{\Pi\Pi}\, X_\Pi\, \Pi_k + U_\Pi\, \Pi_{Xk})/\Delta > 0.$$

In this case $\Pi_k = S$ and $\Pi_{Xk} = S_X$, which together unambiguously imply that the hospital should increase its reliance on salary compensation.

Now suppose that some factor causes the compensation schedule to shift upwards. This is analogous to an inward shift of the supply curve in ordinary labor theory. It could be caused by an exogenous decrease in the market area's physician-to-population ratio, a change in the "mix" of physicians away from those who provide hospital care, or a change in physicians' tastes toward more nonpatient care activities. (We ignore the feedback effect from higher compensation to higher output price.)

The comparative statics derivative dX/dZ is, like dX/dp, ambiguous in sign:

$$(13)\ dX/dZ = -(U_{X\Pi}\, \Pi_Z + U_{\Pi\Pi}\, \Pi_Z\, \Pi_X + U_\Pi\, \Pi_{XZ})/\Delta \gtreqless 0.$$

The first two terms are a negative income effect leading the hospital to choose more patient care. The last term is ambiguous because we do not know the sign of Π_{XZ}; however, if we assume the special non interactive form of equation (9), then $\Pi_{XZ} = 0$ and dX/dZ is clearly negative.

The situation is graphically portrayed in Figure 2, where the hospital moves from point (T-X)* to (T-X)**. The associated compensation method shifts toward a mix with more incentive compensation, Interestingly, in this case, salary may rise or fall. (It is shown here falling).

Insert Figure 2 about here

III. EMPIRICAL ANALYSIS

The theory developed in the previous section focused on the hospital's decision to provide some mix of patient care and nonpatient care. Given the desired output mix, the hospital determines the combination of salary and incentive compensation which will induce physicians to provide optimal quantities of patient care and nonpatient care hours. The comparative statics analysis focused on the effects of changes in exogenous variables on the desired amount of nonpatient care output, and thus on the relative amount of salary compensation.

This theory contrasts to the usual explanation of the choice between salary and incentive compensation, which relies on risks and the costs of supervision.[18] The usual explanation postulates that, because incentive income is more variable and, hence, more risky, the preference for salary income will be stronger on more risky jobs. But, since salaried employees must be supervised to maintain their rate of output, incentive compensation may be more practical in jobs where supervision is costly.

The usual theory can explain many features of physicians' compensation. For example, hospital-based physicians are more often salaried than office-based physicians because supervision is less costly for the former group. They spend a larger fraction of their time in the hospital, and their tasks are more easily defined. In addition, some hospital tasks, e.g., the emergency room, require the continuous presence of physicians to meet risky demands. These physicians are likely to be compensated by salary.

A second reason for expecting certain physicians to be compensated by salary concerns the ease of defining output. For the physician giving insurance physicals, for example, output is well-defined. When part of the physician's output encompasses option demand, as in the emergency room physician case, output is ill-defined, and piece-rate payments may be both inequitable and inefficient. Similarly, research and teaching outputs are much more difficult to define than "pure" patient care, and for this reason, salary should be more common in hospitals where these products are important.

We accept these features of the market and hold them constant in our empirical analysis. Our theory can then make predictions concerning the effects of variables previously unaccounted for. In particular, we believe that the price of output affects the choice of compensation methods, regardless of risk and the cost of on-the-job supervision. Furthermore, since price depends on government reimbursement policy, it follows that government policy affects the choice of physicians' compensation methods.

Following the theory, our empirical specification focuses on three types of variables: (1) factors influencing the price of physicians' services, (2) measures of hospitals' preferences for nonpatient care outputs, and (3) variables which influence the location of the physicians' compensation schedule. Data for the empirical analysis are taken from two independent surveys, described below. The opportunity to estimate the model twice with independent data offers a more robust test of our theory.

1. AHA-MEDORG Survey

The Survey of Medical Staff Organization (MEDORG) was administered to all non-federal U.S. hospitals by the American Hospital Association during December 1972-early 1973. Seventy-six percent of hospitals responded. The survey requested detailed information on contractual and compensation arrangements between the hospital and the medical staff.

The MEDORG Survey was merged with a longitudinal data file on 1,228 U.S. non-federal, short-term general hospitals covering the years1970-75.[19]

This file contains data for constructing explanatory variables corresponding to the hospital's market area. All area variables are defined for 1974. Since most of the area variables change quite slowly, choice of a specific year between 1970 and 1975 is likely to have at most a minor impact on the estimated parameters.

2. IOM Survey

In April 1975 the Institute of Medicine (IOM) conducted a mail survey of all U.S. hospitals which had at least one physician training program. The survey requested data on basic characteristics of teaching hospitals(ownership, size, etc.), the hospital's financial characteristics, and the extent to which the hospital participated in graduate physician training. Approximately 1300 hospitals received questionnaires. The 900 respondents generally represent hospitals with larger, more active teaching programs. We limited the analysis to 709 non-federal, non-specialty hospitals, which were not affiliated with an osteopathic school.

3. Variable Specification

We first describe the variables constructed from the AHA-MEDORG survey. The variables from the IOM survey are conceptually identical but differ in actual construction because of differences in the formats of the two surveys. Differences between the surveys will be described after specification of the estimating equation.

Compensation arrangements are defined by two dependent variables, the proportions of full-time equivalent (FTE) hospital-based physicians and nonhospital-based physicians on salary (HBPSAL and NHBPSAL). Analyzing these groups of physicians separately controls for the effects of factors unique to the hospital-based specialties. Nineteen percent of the HBPs and six percent of the non-HBPs received salary compensation.

The theoretical model necessarily simplified many features of the medical care market by assuming only one input. In reality, of course, hospitals and physicians produce many outputs with different degrees and types of insurance coverage. In general, however, the model predicts that if the substitution effect dominates, factors associated with a high price for physicians' services should have a negative impact on the prevalence of salary compensation. Factors associated with generous insurance coverage of hospital costs should have the opposite effect, since physicians' salaries are generally considered reimbursable expenses.[20]

In terms of generosity of payment for physicians' services, the private insurers (Blue Shield and commercial insurance) tend to rank highest, Medicaid lowest, with Medicare in between.[21] Hence, if dX/dp is negative, our theory predicts that as the proportion of Medicaid patients rises, salary arrangements between hospitals and physicians should become more common.

There are other reasons for expecting that a high Medicaid proportion should be associated with a high proportion of physicians on salary. First, Medicaid patients are less likely to have a single physician as a usual source of medical care. Since the Medicaid patient may see a number of physicians for each medical problem, fee-for-service billing can become exceedingly complicated. Under fixed salary, physician compensation becomes part of the institution's cost pool and is billed to third parties in the same manner as other costs.

Second, Medicaid fee schedules for physicians' services are comparatively low. Medicaid reimbursement for inpatient services is less restrictive. Hence, where Medicaid patients represent an important proportion of the caseload, physicians may be better off on salary with Medicaid patients included in the inpatient cost pool.

Predictions regarding Medicare are less clear because of its intermediate association with the level of physicians' fees. However, both Medicare and Medicaid reimburse hospital expenses on a cost basis (although Medicare requires a deductible). This should have a positive impact on the percentage of physicians receiving salary. We predict, therefore, that Medicaid should have an unambiguous positive impact on salaried arrangements. The implications of Medicare reimbursement are less clear because of possibly off-setting effects. However, we expect its coefficient to be positive, though smaller in magnitude than the Medicaid coefficient. Variables representing Medicaid and Medicare are MCAID and MCARE, the proportions of hospitals' discharged patients who had Medicaid and Medicare coverage.

Other variables influencing reimbursement for physicians' services and hospitals' costs are defined for the hospital's county. Variables MD and Y represent the number of persons in the county per patient-care physician not employed by hospitals and real county per capita income, respectively.[22] Both are expected to have positive impacts on p. High per capita income should also be associated with extensive hospital insurance coverage. Therefore, the expected effect of Y is ambiguous, while MD should have a clear negative impact on salaried arrangements.

Two variables, INSP and INSH, measure the "depth" of insurance coverage in the county for physicians' and hospitals' services, respectively. Each of these variables is an index constructed from household survey data of insurance coverage and premiums.[23] We expect INSP to have a negative sign and INSH a positive sign in the salary equations for both HBPs and non-HBPs.

Hospital's preferences for nonpatient care outputs are measured by several hospital characteristics. As noted above, physician output is less well-defined for option goods and nonpatient care activities. Other things equal, large hospitals are more likely to purchase physicians' nonpatient care time for supervision.[24] To account for this (and other unspecified size effects), three binary hospital size variables are included: SIZE1 = 1 for hospitals with fewer than 100 beds; SIZE2 = 1 for hospitals with 100 to 249 beds; SIZE3 = 1 for hospitals with 250 to 399 beds (400-plus bed hospitals are the reference group).

State and local government hospitals are more likely to provide emergency room services then their voluntary and proprietary hospital counterparts.[25] For this reason, and possibly because they are constrained by civil service regulations, we expect government hospitals (GOVT) to rely more on salary compensation. Proprietary hospitals are identified by the binary variable PROP with voluntary hospitals the reference category.

Teaching and research-oriented hospitals are identified by binary variables: TEACH = 1 for hospitals with major medical school affiliations; LTEACH = 1 for hospitals without major medical school affiliations but with at least one approved internship or residency program; RES = 1 for hospitals with at least one medical staff member with a research project funded from external sources. Positive coefficients are expected on all three variables.

The "Z" variables encompass factors assumed to shift the physician's compensation schedule. Where general practitioners constitute a larger fraction of the physician stock, comparatively few physicians should be available for hospital work. Moreover, preliminary descriptive analysis indicated that salaried arrangements are much more common in the largest metropolitan areas. One interpretation of this relationship is that physicians in metropolitan areas have greater preferences for nonpatient care outputs such as teaching, research, and community outreach. Alternatively, this association could reflect the fact that metropolitan hospitals serve greater proportions of inner city populations, and hence the option demand notion may be applicable here. Variables GP, proportion of physicians who are general practitioners not employed by hospitals, and DENS, population density, represent these influences. Both are defined for the hospital's county.

Variable definitions for the IOM data file differ in several respects. First, the definition of the dependent variable is simply the percentage of physicians on the hospital's medical staff who receive some salary compensation (PMDSAL). The questionnaire does not permit conversion to full-time equivalents or the separation of physicians who are wholly and partially salaried. Second, MCAID and MCARE are defined as the percentage of hospitals' revenues from Medicaid and Medicare. Third, we define a new variable which measures the percentage of hospital revenue from nonpatient care sources (NPAREV). This corresponds to the grants variable, G, in the theoretical model. NPAREV should have a positive effect on the prevalence of salary compensation. Fourth, the categorical variables TEACH and LTEACH are not meaningful for the IOM data, since all the hospitals are teaching institutions. Therefore, we construct a continuous variable, PERTEACH, to measure the extent of educational activity. PERTEACH is the percentage of the hospital's medical staff defined by the hospital as teaching physicians. Finally, it should be noted that the IOM hospitals differ from the MEDORG hospitals in several other respects: there are no hospitals in the smallest size category (SIZE1), no proprietary hospitals, and no hospitals outside of SMSAs.

Table 1 summarizes the variables and their definitions in the two data files.

Insert Table 1 about here

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4. Results

Table 2 presents data from the MEDORG survey which describe the percent distributions of hospital- and nonhospital-based physicians by method of compensation. The distributions are broken down by bed size, form of control, and medical school affiliation. As can be seen, a much higher proportion of hospital-based physicians are paid by salary. This is true regardless of the number of beds or form of control. Teaching hospitals also have a higher proportion of staff physicians on salary than do nonteaching hospitals. Proprietary hospitals are the least likely to maintain salary arrangements with their staff physicians, while government hospitals (particularly teaching institutions) have higher proportions of physicians on salary. These patterns are highly consistent with our theory of how the nature of the product and the hospital's control influence the choice of compensation method. Assessing the impacts of variations in prices and grants requires turning to the regression results.

Insert Table 2 about here

Table 3 presents regressions based on MEDORG data. The regressions explain one-fifth and one-quarter of the variation in HBPSAL and NHBPSAL, respectively. Among the hospital characteristics variables, the most distinct relationships are obtained for the TEACH and RES. Other factors constant, a major medical school affiliation and some funded research raises the proportion of salaried HBPs by 0.13; the corresponding increase for non-HBPs is 0.10. Government hospitals have a higher proportion of salaried non-HBPs than voluntary hospitals; however, government ownership is insignificant in the HBPSAL equation. The fraction of HBPs on salary in proprietary hospitals is about 0.09 and 0.08 lower than for voluntaries and for government hospitals, respectively. The estimated coefficients for LTEACH, though positive, are insignificant at conventional levels. In neither regression does size have a statistically significant impact on the proportion of salaried physicians.

The parameter estimates on MCAID, MCARE, and INSP are readily interpretable. Where Medicaid patients predominate, the proporation of salaried physicians is substantially higher. Indepth private insurance coverage for physicians' services, measured by the variable INSP, can be expected to raise p. As demonstrated earlier, higher p leads to greater reliance on incentive compensation if the substitution effect dominates the income effect in equation (11). The physician insurance variable has a significantly negative impact on HBPSAL, but not on NHBPSAL. The Medicare patient proportion has no impact in either regression.

Insert Table 3 about here

The negative signs of MD and Y coefficients in Table 3 also imply a dominant substitution effect. Presumably, increases in the county population-physician ratio and per capita income raise p which in turn encourages hospitals to produce more patient care. To accomplish this, they rely more on incentive compensation. (Some caution is indicated since the MD and Y parameter estimates are not statistically significant at conventional levels.)

The DENS and GP coefficients indicate that salary arrangements are more common for both HBP and non-HBP physicians in counties with high population density and a low proportion of general practitioners. We realize, however, that DENS may reflect a combination of influences.

Finally, the depth of hospital insurance coverage in the hospital's county (INSH) has positive and significant impacts on both HBPSAL and NHBPSAL. This result is consistent with our prediction of the impact of a change in k, which is positively related to the share of the hospital's costs covered by insurance. With more complete coverage for inpatient services, physician compensation is more easily accommodated as a hospital cost.

Table 4 reports regressions on the IOM data. The dependent variable in these equations is the percentage of physicians on the hospital's medical staff who receive some salary compensation. Equation 1 uses data from 165 teaching hospitals located in counties for which the two depth-of-insurance variables, INSP and INSH, are available. Equation 2 focuses strictly on hospitals' revenue and teaching characteristics. Eliminating INSP and INSH more than doubles the available sample size to 338 hospitals.

Preliminary regressions indicated that several variables (GOVT, SIZE2, SIZE3, MD, Y, DENS and GP) were both jointly and individually insignificant (F(13,151) = .4).[26] Therefore, the coefficients of these variables are not reported here. The coefficients in Equation 1 are qualitatively similar to those estimated with the AHA-MEDORG data. The percentage of revenue from Medicare (MCARE) is not statistically significant, while the percentage of Medicaid revenue (MCAID) has a positive and significant impact as predicted. The two depth of insurance variables, INSP and INSH, also enter with the expected signs, although only INSH is significant. These results are also consistent with the notion that high fees for physicians' services lead to less salary compensation. Conversely, more coverage for hospital care has the opposite effect. The two unique variables in the IOM data, percentage of nonpatient care revenue (NPAREV) and percentage of teaching physicians (PERTEACH) also have the expected signs. These variables measure grants made to the hospital and the hospital's preference for non patient care activities.

Insert Table 4 about here

In spite of the differences among the hospital samples, the IOM results are consistent with the AHA-MEDORG findings. Focusing only on teaching institutions does not alter any of the basic qualitative findings. In addition, the IOM equations underline the importance of nonpatient care revenues and activities as determinants of the hospital's compensation method.

IV. SUMMARY AND CONCLUSIONS

The objective of this paper was to investigate the arrangements used by hospitals to compensate physicians. In spite of the physician's key role in hospital decision making, there has been surprisingly little research on this issue. This topic is also of interest because it contributes to understanding the more general problem of professional compensation arrangements and because it is relevant to current policy issues, i.e., Medicare reimbursement of teaching and hospital-based physicians.

Earlier theoretical analyses of contractual arrangements have focused on the implications of risk, imperfect information, and the cost of supervision. The model developed here takes these results as given and concentrates on the consequences of changes in prices of medical care and grants to hospitals. In general, the model predicts that increasing the price of medical care induces the hospital to provide more patient care services. It does this by increasing the amount of incentive compensation for staff physicians. An increase in grants (nonpatient care revenues) has the opposite effect.

Empirical tests of the model used data from two hospital surveys, one conducted by the American Hospital Association in 1973 and the other by the Institute of Medicine in 1975. The former included all U.S. hospitals while the latter was restricted to teaching hospitals. The dependent variable was the percentage of physicians receiving salary compensation. Independent variables measured hospitals' preferences for nonpatient care activities and revenues from nonpatient care sources, factors affecting the price of physicians' services and the reimbursement of hospitals' costs, and shift factors in the physician's compensation schedule.

In general, the empirical results based on the two data files are consistent with each other and with the implications of the theoretical model. Variables associated with high prices for physicians' services (low MCAID, high MD, Y, and INSP) all have a negative impact on the percentage of salaried physicians. Conversely, nonpatient care variables (teaching, research, and high nonpatient care revenues) have a positive association with salary compensation.

Of particular interest for policy purposes are the coefficients of the Medicare and Medicaid variables, MCARE and MCAID. The insignificance of MCARE suggests that cost reimbursement of hospitals per se is not a factor influencing the choice of compensation method (although the extent of insurance coverage for hospital services, measured by INSH, is). Since MCAID enters with a positive and highly significant coefficient in all equations, this suggests that public policy affects compensation arrangements through its impact on the price of physicians' services. Another implication is that prohibiting percentage-of-revenue arrangements for HBPs will simply lead to more fee-for-service billing, rather than salary, as long as physicians' fees continue to be high. Thus, if it is thought that salaried compensation is in some sense "better" (which in the context of our model means the delivery of fewer patient care services) the appropriate objective for public policy would be to constrain physicians' fees. Finally, the insignificance of MCARE in both the teaching hospital and nonhospital-based physician equations also suggests that incentives for double billing by teaching physicians may not be as great as implied by the proposed Section 227 regulations to the Social Security Act.

These findings and implications must, of course, be treated as tentative because of the quality of the underlying data. More complete information is needed on physicians' full compensation (including fringe benefits), on insurance coverage, and on prices for physicians' and hospitals' services. A better understanding of the physician-hospital interaction should contribute to developing public policies for attaining improved access to medical care at reasonable costs.

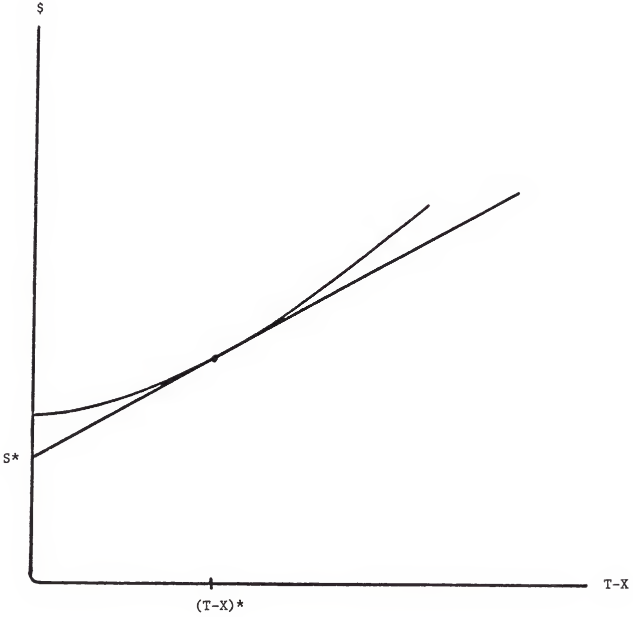

Figure 1

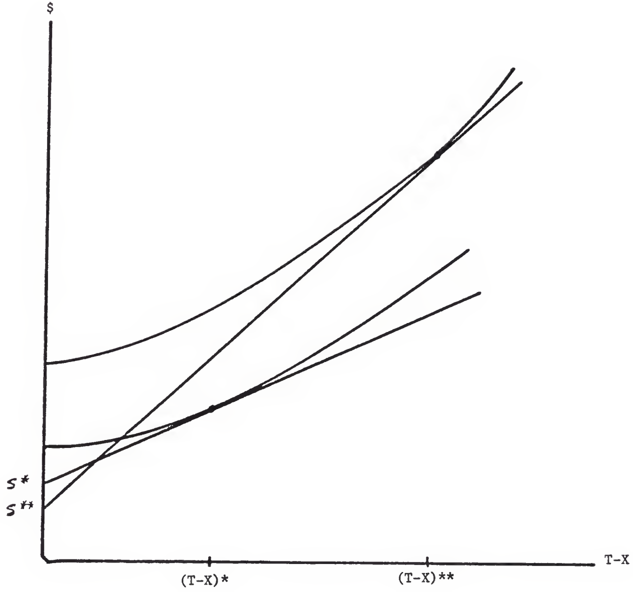

Figure 2

Table 1

Variable Definitions, MEDORG and IOM Data Files

Variable Name	MEDORG DEFINITION	IOM DEFINITION
HBPSAL	proportion of FTE hospital based physicians on salary	—
NHBPSAL	proportion of FTE nonhospital based physicians on salary	—
PMDSAL	—	proportion of medical staff receiving salary
SIZE1	LT 100 beds	NA
SIZE2	100 to 249 beds	SAME
SIZE3	250 to 399 beds	SAME
PROP	prorietary hospital	NA
GOVT	nonfederal, government hospital	SAME
TEACH	major medical school affilation	—
LTEACH	teaching program but no medical school affiliation	—
PERTEACH	—	proportion of medical staff designated teaching physicians
RES	at least 1 staff member with outside-funded research	—
NPAREV	—	percent of revenue from nonpatient care sources
MCAID	percent of discharged patients with Medicaid coverage	percent of revenue from Medicaid
MCARE	percent of discharged patients with Medicare coverage	percent of revenue from Medicare
INSP*	depth of insurance coverage for nonhospital services	SAME
INSH*	depth of insurance coverage for hospital services	SAME
MD*	population per patient-care physician not employed by hospitals	SAME
Y*	real per capita income	SAME
DENS*	population per square mile	SAME
GP*	proportion of nonhospital physicians who are general practitioners	SAME

*defined for hospital's county

NA= Not Applicable

Table 2

Hospital-Physician Compensation Arrangements for Hospital-Based and Non Hospital-Based Physicians

	Number of Beds											
	< 100			100-249			250-399			> 400		
	% Salary	% Contract Other Than Salary	% No Contract	% Salary	% Contract Other Than Salary	% No Contract	% Salary	% Contract Other Than Salary	% No Contract	% Salary	% Contract Other Than Salary	% No Contract
Hospital Based Physicians												
Voluntary												
Teaching	*	*	*	31.0	42.3	26.8	21.8	42.2	36.0	23.0	41.0	36.0
Non-teaching	7.9	52.1	40.1	12.8	50.9	36.4	13.4	45.4	41.3	8.8	48.7	42.6
State government												
Teaching	*	*	*	*	*	*	26.8	28.8	44.5	15.6	44.4	40.1
Non-teaching	33.4	26.2	40.1	12.5	52.3	*	*	*	*	*	*	*
Other governmental (non-federal)												
Teaching	*	*	*	38.9	35.3	25.8	41.3	26.8	31.9	43.6	21.7	34.7
Non-teaching	3.7	54.8	41.5	8.8	60.4	30.8	9.5	50.8	39.7	0.3	15.6	84.1
Proprietary												
Chain	13.8	46.4	39.8	15.8	40.1	44.1	*	*	*	*	*	*
Other	5.4	44.7	50.1	5.8	43.5	50.8	*	*	*	*	*	*
NonHospital Based Physicians												
Voluntary												
Teaching	*	*	*	13.1	3.7	83.2	6.1	4.1	90.0	8.8	4.9	86.3
Non-teaching	2.0	4.6	93.5	2.8	3.8	93.4	2.6	3.3	94.1	1.7	4.2	94.1
State government												
Teaching	*	*	*	*	*	*	16.6	23.2	60.2	9.4	29.6	61.1
Non-teaching	52.4	11.1	36.5	15.3	8.3	76.5	*	*	*	*	*	*
Other governmental (non-federal)												
Teaching	*	*	*	30.8	17.4	51.8	36.5	1.3	62.2	37.5	2.1	60.4
Non-teaching	1.6	5.9	92.5	2.3	4.2	93.5	4.6	6.6	88.8	1.7	4.1	94.2
Proprietary												
Chain	10.4	10.5	79.2	2.5	3.5	94.0	*	*	*	*	*	*
Other	10.6	6.5	92.9	0.6	3.4	96.1	*	*	*	*	*	*

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* Five or fewer hospitals

Table 3 Empirical Results: MEDORG

Variable	Means and Std. Devs.		HBPSAL Regression		NHBPSAL Regression	
HBPSAL	0.19	(0.31)	—	(—)	—	(—)
NHBPSAL	0.06	(0.16)	—	(—)	—	(—)
SIZE1	0.19	(0.39)	0.018	(0.039)	-0.016	(0.020)
SIZE2	0.34	(0.47)	0.0049	(0.038)	-0.018	(0.017)
SIZE3	0.26	(0.44)	-0.0099	(0.029)	-0.022	(0.015)
PROP	0.10	(0.30)	-0.092[a]	(0.032)	-0.011	(0.017)
GOVT	0.15	(0.36)	-0.013	(0.027)	0.099[a]	(0.014)
TEACH	0.26	(0.44)	0.070[a]	(0.030)	0.066[a]	(0.015)
LTEACH	0.09	(0.29)	0.021	(0.034)	0.022	(0.018)
RES	0.23	(0.42)	0.062[b]	(0.026)	0.035[a]	(0.013)
MCAID	0.11	(0.10)	0.41[a]	(0.10)	0.19[a]	(0.05)
MCARE	0.26	(0.13)	0.014	(0.071)	0.031	(0.036)
INSP	72.84	(20.01)	-0.0028[a]	(0.0007)	-0.00019	(0.00035)
MD	1.21	(3.74)	-0.0063	(0.0069)	-0.0016	(0.0012)
Y	4.25	(10.65)	-0.018	(0.016)	-0.013	(0.007)
DENS	4.36	(9.82)	0.0063[a]	(0.0011)	0.0042[a]	(0.0005)
GP	0.22	(0.14)	-0.12	(0.08)	-0.072[c]	(0.042)
INSH	178.02	(35.92)	0.0025[a]	(0.0003)	0.00030[c]	(0.00017)
Constant	—	(—)	-0.040	(—)	0.023	(—)
			R^2=0.21 $R^2(C)$=0.20 F(16,960)=15.9		R^2=0.26 $R^2(C)$=0.25 F(16,960)=21.6	

Key: HBPSAL=proportion of full-time equivalent hospital-based physicians on salary; NHBPSAL =proportion of full-time equivalent non-hospital-based physicians on salary; SIZE1, SIZE2, SIZE3=1, respectively, if hospital has < 100, 100-249, 250-399 beds; PROP=1 if ownership is proprietary; GOVT=1 if ownership is state-local government; TEACH=1 if hospital has major medical school affiliation; LTEACH=1 if hospital has approved internship and/or residency program and no major medical school affiliation; RES=1 if hospital has at least one active medical staff member with outside funding for research; MCAID=proportion of hospital's patients discharged who had Medicaid coverage; MCARE=proportion of hospital's patients discharged who had Medicare; INSP=depth of private insurance coverage in county for non-hospital services; MD= county population per county patient care physician not employed by hospitals (in 000s); Y= real per capita income in county (in 000s); DENS=population per square mile in county (in 000s); GP=proportion of physicians in county included in denominator of MD who are general practitioners; INSH=depth of insurance coverage in county for hospital services; a=statistically significant at 1% level (two tail test); b=statistically significant at 5% level (two tail test); c=statistically significant at 10% level (two tail test).

Table 4

Empirical Results: IOM

Variable	Equation 1 Mean (Std. Dev.)	Equation 1 Regr. Coeff. (Std. Error)	Equation 2 Mean (Std. Dev.)	Equation 2 Regr. Coeff. (Std. Error)
PSALMD	0.18 (0.24)	—	0.22 (0.29)	--
MCARE	0.30 (0.10)	-0.114 (0.194)	0.28 (0.11)	-0.201 (0.133)
MCAID	0.11 (0.11)	0.905^a (0.183)	0.11 (0.11)	0.348^a (0.129)
NPAREV	0.08 (0.12)	0.142 (0.153)	0.11 (0.17)	0.528^a (0.090)
PERTEACH	0.26 (0.28)	0.241^a (0.057)	0.28 (0.30)	0.359^a (0.045)
INSP	70.46 (19.71)	-0.0014 (0.0011)	--	--
INSH	173.54 (33.20)	0.0014^b (0.0006)	--	--
(N)	(165)	$R^2(C)=0.31$ $F(6,158)=13.11$	(338)	$R^2(C)=0.32$ $F(4,333)=39.84$

Key:
PSALMD = percent salaried physicians
MCARE = percent Medicare revenues
MCAID = percent Medicaid revenues
NPAREV = percent nonpatient care revenues
PERTEACH = percent teaching physicians
INSP = depth of insurance for physicians' services
INSH = depth of insurance for hospitals' services

a = statistically significant at 1% level (two-tail test)
b = statistically significant at 5% level (two tail test)

Footnotes

[1] There are a few exceptions. See Pauly and Redisch (1973), Feldman (1976), Harris (1977), and Redisch (1978).

[2] See Jacobs (1974) and Davis (1972) for reviews of alternative hospital theories.

[3] Sloan (1974), Pauly (1970), Lee and Hadley (1979).

[4] Gibson and Fisher (July 1978), p.6.

[5] Other possibilities include percentage of gross departmental revenue, percentage of net departmental revenues, salary only, and salary plus percentage of revenues.

[6] See Knapp and Butler (1979). The potential for this form of double billing arises because of the dual treatment by most insurance plans of hospitals' and physicians' services. Medicare, most Medicaid programs, and half of the Blue Cross plans treat salaries paid to physicians for educational activities as allowable expenses under reasonable cost reimbursement. At the same time, physicians are permitted to submit separate bills for identifiable services provided to their patients.

[7] See Steinwald (1979) for a discussion of trends in the compensation of HBPs.

[8] See Arthur Andersen (1977) and Redisch (1978).

[9] See Markusen (1979) or Stiglitz (1975) for examples.

[10] American Hospital Association (1973).

[11] Institute of Medicine (1976).

[12] See Newhouse (1970) or Feldstein (1971) for examples of hospital objective functions which include quality of care.

[13] In reality, there is not a strict one-for-one correspondence between fee-for-service billing of physicians' service and fee-for-service compensation of physicians. The hospital or a medical service plan may collect fees charged at price p and compensate staff physicians under any combination of incentive, f, and time, S, methods. We abstract from the intermediary function of the hospital for simplicity.

[14] Extent refers to number of people with hospital insurance while depth may be thought of in terms of how much of the bill is covered. Together, these factors determine how much of a hospital's expenses will be covered by insurance. Note that this parameter does not distinguish between cost reimbursement, charge reimbursement, or other payment methods.

[15] Lancaster (1966).

[16] Rosen (1974).

[17] Several corner solutions for this maximization problem are possible, for example, $S = 0$ and $p = f$ define fee-for-service compensation. We concentrate our attention here on interior solutions. We also use the constraint $S + f(T-X) = C(.)$, from which it follows that $S_X = C_X + f - f_X (T-X)$. But $-C_X = f$ so $S_X = -f_X (T-X)$. This equality is used to simplify the first-order condition.

[18] See Footnote 9.

[19] The longitudinal data file is described by Sloan and Steinwald (1980).

[20] A hospital's revenues are comprised of funds from cost-based and charge-based payers. The latter includes uninsured patients and patients with commercial insurance, which is generally less generous than insurance which pays the hospital's costs. According to Berman and Weeks (1979), charges tend to be set in order to make up the difference between cost-based revenues and total expenditures. If the proportion of cost-based revenue is low, then hospitals should prefer to keep the costs of physicians' services out of their accounts by having physicians bill separately on a fee-for-service basis.

[21] Sloan, Cromwell, and Mitchell (1978), p. 89.

[22] For a discussion of the cost-of-living deflator, see Sloan and Steinwald (1980).

[23] See Sloan and Steinwald (1980) for details of the construction of INSP and INSH.

[24] Sloan (forthcoming).

[25] See, for example, Roos et al. (1974).

[26] We suspect that this is due to the significant differences in the nature of the IOM sample hospitals compared to the AHA-MEDORG hospitals. Comparing mean values of some of the regression variables shows some striking differences: 60 percent of the IOM hospitals are in the largest size category, compared to 20 percent of the AHA-MEDORG hospitals; population per square mile and population per office-based physician are much higher in the IOM sample. In general, the IOM hospitals are much larger and much more likely to be located in large urban areas.

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